

# Claims

- [c1] A system for use in an electric submersible pumping system, comprising:  
a motor protector having an outer housing, an internal shaft, a fluid separation section and a head section, the head section having an abrasives exclusion mechanism to reduce motor protector wear.
- [c2] The system as recited in claim 1, wherein the abrasives exclusion mechanism comprises an upper shaft seal elevated above the floor of the head section.
- [c3] The system as recited in claim 1, wherein the abrasives exclusion mechanism comprises a drainage hole disposed through the outer housing at a lower end of the head section.
- [c4] The system as recited in claim 2, wherein the abrasives exclusion mechanism comprises a stationary shroud deployed over the upper shaft seal.
- [c5] The system as recited in claim 4, further comprising a rotatable shroud attached to the internal shaft proximate the stationary shroud.

- [c6] The system as recited in claim 1, wherein the head section comprises a fluid port disposed through a lower end floor of the head section, and the abrasives exclusion mechanism comprises a stand tube extending upwardly from the fluid port.
- [c7] The system as recited in claim 6, wherein the stand tube comprises a barrier that prevents the entry of abrasives into the stand tube.
- [c8] The system as recited in claim 1, wherein the internal shaft comprises an internal air vent passageway.
- [c9] The system as recited in claim 1, wherein the internal shaft is supported by at least one keyless journal bearing.
- [c10] The system as recited in claim 1, wherein the motor protector further comprises a valve, the valve being inwardly oriented to relieve excessive negative pressure within the motor protector.
- [c11] The system as recited in claim 1, wherein the motor protector further comprises a bag section, the bag section having a fiber-reinforced polymer bag.
- [c12] A pumping system, comprising:
  - a submersible pump;

a submersible motor to power the submersible pump;  
and  
a motor protector fluidically coupled to the submersible motor, the motor protector having a head section with a head section bearing and an abrasives exclusion mechanism to reduce the amount of abrasive material contacting the head section bearing.

[c13] The system as recited in claim 12, wherein the motor protector is disposed between the submersible pump and the submersible motor.

[c14] The system as recited in claim 12, wherein the head section bearing comprises a keyless journal bearing.

[c15] The system as recited in claim 12, wherein the head section comprises an internal chamber into which a drive shaft extends.

[c16] The system as recited in claim 15, wherein the abrasives exclusion mechanism comprises a shaft seal located about the drive shaft at an elevated position within the internal chamber.

[c17] The system as recited in claim 14, wherein the abrasives exclusion mechanism comprises a shroud disposed over the shaft seal.

- [c18] The system as recited in claim 15, wherein the abrasives exclusion mechanism comprises a drainage hole disposed through the outer housing at a lower end of the head section.
- [c19] The system as recited in claim 15, wherein the motor protector further comprises a labyrinth section and a bag section.
- [c20] The system as recited in claim 15, wherein the head section comprises a fluid port that extends to a lower motor protector section, the fluid port being coupled to a stand tube extending into the internal chamber.
- [c21] The system as recited in claim 12, wherein the motor protector further comprises a valve, the valve being inwardly oriented to relieve excessive negative pressure within the motor protector.
- [c22] The system as recited in claim 19, wherein the bag section has a fiber-reinforced polymer bag.
- [c23] A method of improving the performance of a motor protector used in abrasive conditions, comprising:  
rotatably mounting a shaft through a bearing and a shaft seal positioned within a motor protector housing;  
providing a head section into which an upper end of the shaft extends; and

protecting the bearing and the shaft seal from contact with sand entering the head section.

- [c24] The method as recited in claim 23, wherein rotatably mounting comprises mounting the shaft in a pair of keyless bearings.
- [c25] The method as recited in claim 23, wherein providing comprises forming a head section chamber within the motor protector housing and above a lower portion of the head section.
- [c26] The method as recited in claim 25, wherein protecting comprises mounting the shaft seal at an elevated position above the lower portion.
- [c27] The method as recited in claim 25, wherein protecting comprises locating a stationary shroud within the head section chamber above the bearing.
- [c28] The method as recited in claim 27, wherein protecting further comprises attaching a rotatable shroud to the shaft proximate the stationary shroud to create a centrifuge effect during operation.
- [c29] The method as recited in claim 25, wherein protecting comprises forming at least one hole through the motor protector housing proximate the lower portion to pro-

vide a passageway for dispelling abrasives from the head section chamber.

- [c30] The method as recited in claim 25, further comprising placing a fluid port through the lower portion of the head section to provide fluid communication between the head section chamber and a lower motor protector section.
- [c31] The method as recited in claim 30, further comprising locating a stand tube in the head section chamber and coupling the stand tube to the fluid port.
- [c32] The method as recited in claim 31, further comprising bending the stand tube.
- [c33] The method as recited in claim 31, further comprising placing a filter in the stand tube.
- [c34] The method as recited in claim 31, further comprising creating a tortuous path along the stand tube.
- [c35] The method as recited in claim 31, further comprising placing a cap above the stand tube.
- [c36] The method as recited in claim 23, further comprising venting a gas through the shaft.
- [c37] The method as recited in claim 23, further comprising

positioning a relief valve to relieve excessive negative pressure within the motor protector.

- [c38] A pumping system, comprising:
  - a submersible pump;
  - a submersible motor to power the submersible pump;
  - and
  - a motor protector fluidically coupled to the submersible motor, the motor protector having a head section with a shaft seal and an abrasives exclusion mechanism to reduce the amount of abrasive material contacting the shaft seal.
- [c39] The system as recited in claim 38, wherein the abrasives exclusion mechanism comprises a head section journal bearing protected by the abrasives exclusion mechanism.
- [c40] The system as recited in claim 38, wherein the abrasives exclusion mechanism comprises a shroud disposed over the shaft seal.
- [c41] The system as recited in claim 38, wherein the abrasives exclusion mechanism comprises a drainage hole disposed through the outer housing at a lower end of the head section.
- [c42] The system as recited in claim 38, wherein the head sec-

tion comprises a fluid port that extends to a lower motor protector section, the fluid port being coupled to a stand tube extending into the internal chamber.

[c43] The system as recited in claim 38, wherein the motor protector further comprises a valve, the valve being inwardly oriented to relieve excessive negative pressure within the motor protector.

[c44] A system for improving the performance of a motor protector used in abrasive conditions, comprising:  
means for rotatably mounting a shaft in a bearing positioned within a motor protector housing;  
means for providing a head section chamber into which a shaft extends; and  
means for protecting the bearing by which the shaft is rotatably supported.

[c45] The system as recited in claim 44, wherein the means for rotatably mounting comprises a keyless journal bearing.

[c46] The system as recited in claim 44, wherein the means for providing comprises a head section formed within an outer motor protector housing.

[c47] The system as recited in claim 44, wherein the means for protecting comprises a sand diverter mechanism to prevent sand from contacting the bearing.



